Pediatric antimicrobial therapy III

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Introduction

This is the third in a series of articles intended to present a summary of current recommendations for the use of antimicrobial therapy in the pediatric age group. Parts I and II appeared in the Journals of July 7 and 21, 1973 and Parts IV to VI will be published in successive issues.

Lincomycin

Spectrum	Probably will be replaced by clindamycin.[36] Gram-positive organisms except *Streptococcus faecalis.* Resistant pneumococci and Group A streptococci have been reported. Poor for *H. influenzae* and mycoplasma.
Dose	Oral — 50-100 mg./kg./day divided *q8h.* IM — 10-20 mg./kg./day divided *q12h.* IV — 10-20 mg./kg./day divided *q8h.* Newborn — do not use under 1 month of age. Adult — 1.8-2.4 g./day divided *q6-8h.*
Incompatibility	Do not mix with erythromycin, cyclamates.
Toxicity	Diarrhea, nausea, vomiting. Rash, rectal irritation, vaginitis, urticaria, SGOT rise[25] with or without jaundice (see erythromycin). Neutropenia and/or leukopenia.
Comment	The evidence for this drug being as good or better than penicillinase-resistant penicillins in osteomyelitis is scanty.[37,38] It should only be used in such cases with knowledge of the MIC of the organism and when the serum levels can be followed.

Methenamine mandelate

Spectrum	Chronic urinary tract infections with gram-negative bacteria.[39]
Dose	Oral — 100 mg./kg. to start, then 50 mg./kg./day divided *q8h.*
Comment	Urine should be kept acid (<pH 5.5 to release formaldehyde) with ascorbic acid or methionine.
Toxicity	GI disturbance, dysuria, crystalluria.

Nalidixic acid

Spectrum	Useful in gram-negative urinary tract infections[40] for *E. coli,* enterobacter, serratia, klebsiella, proteus; pseudomonas is generally resistant.
Dose	Oral — 10-12 mg./kg./day.
Toxicity	GI symptoms; hypersensitivity (pruritus, rash, urticaria). Eosinophilia; seizures, psychosis. Photosensitivity. Intracranial hypertension.
Comment	Toxicity is low; may be used for months. Resistance frequently develops. Use cautiously in patients with liver disease and/or impaired renal function. Do not use in children under 1 month of age or for infections other than those of urinary tract. Chronic pulmonary reactions secondary to nalidixic acid have been reported. Sensitivities as reported from the bacteriology laboratory correspond to urine, not serum levels.

Neomycin

Spectrum	Bactericidal for some gram-positive cocci and gram-negative bacilli.
Dose	Oral — *not absorbed*[41] — 100 mg./kg./day divided *q6h.* Newborn: term, premature — oral 50 mg./kg./day divided *q6h.* Aerosol — 2 ml. *q6h* (50 mg./ml.). 17-20 mg./kg./day divided *q6h* (as aerosol) produced blood levels of 1.3-2.5 μg./ml. (Toxic serum level 1.5-4.8 μg./ml.).
Toxicity	Probably more nephrotoxic and ototoxic when used parenterally than kanamycin. Oral use causes diarrhea, reversible disaccharidase deficiency,[42] negative nitrogen balance, malabsorption, moniliasis and, rarely, deafness.[43] Topical use causes rashes and skin sensitization.[44] Intrapleural or intraperitoneal use can lead to respiratory arrest (curare-like effect) which is potentiated by ether anesthesia and reversible by neostigmine (sometimes by Ca^{++}).[23] *Use with caution by all routes in patients with renal and hepatic disease including the relatively oliguric newborn and in myasthenia gravis and anesthetized patients.*

Nitrofurantoin

Spectrum	Many gram-negative bacteria are susceptible to concentrations achieved in urine.
Dose	Oral — 5-7 mg./kg./day — reduce dosage after 10-14 days. Infant — 1.5 mg./kg./day. Adult — 400 mg. *qd* divided *q6h.*
Toxicity	Hemolytic anemia. Peripheral neuropathy (usually seen in diabetes, renal failure, etc.).[45] Rash. Chills, fever, myalgia. Eosinophilia. Pulmonary infiltration.[46] Cholestatic jaundice, GI disturbances very common.
Comment	Should only be used for urinary tract infections. Sensitivities as reported from the bacteriology laboratory correspond

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to urine not serum levels. Not recommended IV or in patients with renal impairment.[45]

Para-aminosalicylic acid (PAS)

Spectrum — *Mycobacterium tuberculosis*

Dose — Oral — 250-300 mg./kg./day divided *q6h.*
Adult — 12 g./day

Toxicity — GI symptoms — nausea, diarrhea, anorexia, vomiting. Hypersensitivity (skin rash, fever).

Comment — *Avoid or reduce dosage to one half when renal function impaired. Stop drug at first sign of skin rash.* Leukopenia, hemolytic anemia, suppression of thyroid function and purpura (rare). Urine reduces Benedict's reagent.

Penicillins[47]

Comment — Because of protein binding, serum killing power may be a useful test for bacterial sensitivity and efficacy of therapy. All penicillins are cross-allergenic. Tetracyclines and chloramphenicol may be antagonistic to the penicillins. In serious infections, all penicillins should be divided so that a dose is given every four hours. To desensitize when penicillin must be used in the presence of penicillin sensitivity:[48]

(1) Scratch — 1000 u/ml.
(2) Scratch — 10,000 u/ml.
(3) ID — 0.1 ml. of solution of 1000 u/ml.
(4) If no reaction, proceed with continuous IV therapy under close supervision. An alternate agent (non-penicillin) is probably indicated under these circumstances.

Toxicity — In general, toxicities are not dose-related. Hyperpotassemia, CNS irritation with myoclonic convulsions and superinfection are probably exceptions to this rule.

Penicillins rendered ineffective by penicillinase:

ampicillin, carbenicillin, penicillin G, procaine penicillin, phenoxymethyl penicillin

Ampicillin

Spectrum — An increasing number of salmonella, shigella, proteus (non-mirabilis), enterobacter and klebsiella are resistant (varies with each hospital). Streptococci, pneumococci, non-penicillinase producing staphylococci, *H. influenzae,* listeria and meningococci are sensitive.

Dose — Oral — 50-150 mg./kg./day divided *q6h.*
IM, IV — 150-400 mg./kg./day divided *q4h. Not stable in IV bottle.* For meningitis, begin with at least 200 mg./kg./day divided *q4h.*
Newborn — 100 mg./kg./day divided *q8h* for 1st two weeks of life, then *q4-6h.*

Toxicity — Low toxicity. Diarrhea, skin rash, drug fever, superinfection. Hemolytic anemia.

Comment — Susceptibility testing desirable prior to the therapy of gram-negative bacillary infections. Useful for genitourinary, salmonella and shigella infections and *H. influenzae* meningitis. A loading dose of 50 mg./kg. is desirable in serious infections. Contains 1.7 mEq. Na^+ per 500 mg. of drug. Ampicillin levels in the CSF drop after the third day in meningitis as the pleocytosis decreases; the drug must be given intravenously for the entire course.[49] Alkaline pH of IV solutions may inactivate if administered over > one hour.[50] May falsify urinary amino-acid chromatogram.[51]

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